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(54) Abstract Title  
Method for the emergency unlocking of a vehicle due to an accident

(57) In a method for the emergency unlocking of a vehicle involved in an accident, the occurrence of an accident being recognized by an accident recognition unit on account of the evaluation of sensor signals, automatic unlocking of the vehicle is carried out after an accident recognized by the unit only if the rotational-speed signal of one or more wheels of the vehicle assumes the value zero within a certain accident time frame, and/or if the output voltage of the generator of the vehicle assumes the value zero within a certain accident time frame, or if an accident has been recognized by the accident recognition unit within a specified period of time after the vehicle speed is reduced to zero with a deceleration which is greater than a defined threshold value.

Emergency unlocking may also be dependent upon the ignition being on, a pre-determined severity of accident being sensed, or tilting or overturning of the vehicle being sensed.

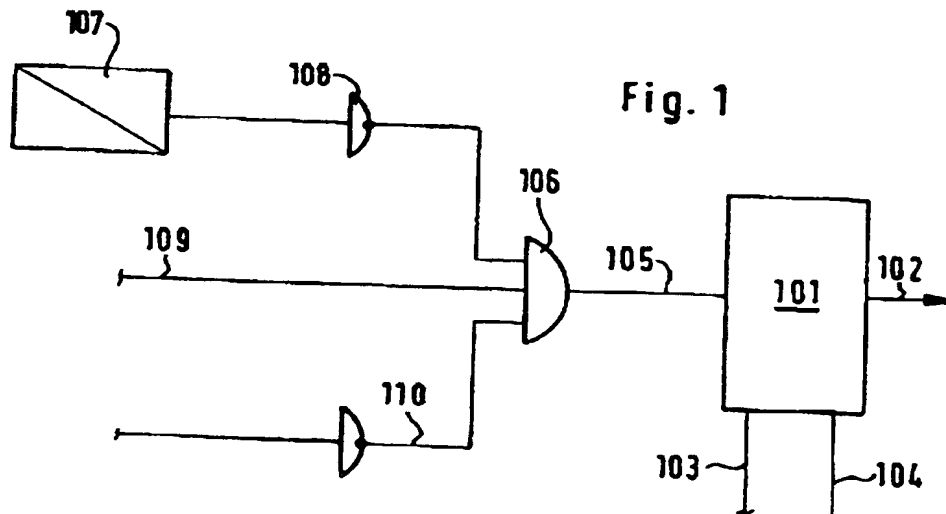


Fig. 1

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Method for the emergency unlocking of a vehicle due  
to an accident

The present invention relates to a method for the emergency unlocking of a vehicle due to an accident in which the occurrence of an accident is recognized by an accident recognition unit on account of the evaluation of sensor signals, automatic unlocking of the vehicle being carried out after an accident recognized by the unit.

A method of this type is disclosed, for example, in DE 31 16 906 A1, according to which an acceleration switch is provided which can be used to recognize deceleration of the vehicle above a certain threshold value. In this case, deflection of an element of the acceleration switch causes production of an electrical connection by means of which the central locking device of the vehicle is activated for the purpose of opening the vehicle. The vehicle is only opened in this case if the ignition of the vehicle is switched on. The aim thereby is, in the event of an attempt at theft, to prevent the vehicle from being struck mechanically, for example by impacts against the bodywork, the consequence being that the vehicle opens automatically. The assumption here is that with the ignition switched on, i.e. with the ignition key inserted, the situation concerns an accident rather than an attempt to steal the vehicle.

This emergency unlocking is intended to facilitate the rescuing and medical care of the vehicle occupants after an accident if the vehicle has been driven in the locked state.

The present invention proposes a method for the emergency unlocking of a vehicle due to an accident, in which a differentiation is made as to whether the situation actually concerns an accident or, manipulation of the emergency-unlocking system so as, unauthorized, to open the vehicle to gain access to the vehicle interior.

According to the present invention there is provided a method for the emergency unlocking of a vehicle involved in an accident, the occurrence of an accident being recognized by an accident recognition unit on account of the evaluation of sensor signals, automatic unlocking of the vehicle being carried out after an accident recognized by the unit, wherein automatic unlocking is only ever carried out if the rotational-speed signal of one or more wheels of the vehicle assumes the value zero within a certain accident time frame.

If the vehicle is bumped by another vehicle, for example while being driven, the accelerations or decelerations which occur may already have caused the unit to conclude that an accident has occurred. However, if the vehicle travels further, it can be recognized that the situation does not concern an accident necessitating emergency unlocking, but rather that automatic unlocking should not happen because a third party has obviously attempted to trigger the emergency unlocking, by means of an impact against the vehicle, so as to gain access to the vehicle interior.

According to a second aspect of the invention, there is provided a method for the emergency unlocking of a vehicle involved in an accident, the occurrence of an accident being recognized by an accident recognition unit on account of the evaluation of sensor signals, automatic unlocking of the vehicle being carried out after an accident recognized by the unit, wherein automatic unlocking is only ever carried out if the output voltage of the generator of the vehicle assumes the value zero within a certain accident time frame.

The assumption here is that in the event of an "genuine" accident, the internal combustion engine stops because it is defective or is switched off by the vehicle driver. If then after the accident the internal combustion engine continues to run, the assumption is that it is not a genuine accident so emergency unlocking should not take place.

Claim 3 is a combination of features from Claims 1 and 2 and thus is a further improvement in the certainty in recognising and deducing the necessity of whether the emergency unlocking should be triggered after a recognized accident.

The term "time frame" in conjunction with Claims 1, 2 and 3 means that the vehicle or the internal combustion engine of the vehicle should stop a certain time after the recognized accident. This does not have to occur directly and, as it were, isochronously with the accident because it is possible, for example in the event of a "genuine" accident, for the vehicle to collide with a wall and consequently to go into a skid. The accident is already recognized during the collision with the wall. However, the vehicle goes into a skid a certain time after the impact - as a function of the impact speed - and consequently is still moving. The "time frame" has thus to be defined such that stopping of the vehicle after such a skidding movement is still evaluated, in conjunction with the impact against the wall, as one accident. For example, a period

of time can be specified within which the vehicle has to come to a stop. This period of time can also, for example, be defined as a function of the travelling speed at the instance of recognition of the accident.

According to another aspect of the invention, there is provided a method for the emergency unlocking of a vehicle involved in an accident, the occurrence of an accident being recognized by an accident recognition unit on account of the evaluation of sensor signals, automatic unlocking of the vehicle being carried out after an accident recognized by the unit, wherein automatic unlocking is only ever carried out if an accident has been recognized by the accident recognition unit within a specified period of time after the vehicle speed is reduced from a value which is not equal to zero to the value zero with a deceleration which is greater than a defined threshold value.

As a result, pronounced deceleration of the vehicle, which typically can be due to an accident, together with subsequent stopping of the vehicle is advantageously correlated with the recognition of an accident. A differentiation can be made, in a particularly reliable and error-free manner, as to whether the situation concerns a "genuine" accident or an attempt to trigger the emergency unlocking by striking the vehicle.

Preferably, automatic unlocking is only ever carried out if the vehicle speed was greater than a defined minimum amount for a certain time before being reduced to zero with the deceleration which is greater than the defined threshold value.

As a result, it can advantageously again be recognized whether the vehicle was "bumped" by a differentiation being made as to whether the vehicle was being driven or was parked directly before the recognized accident. If a parked vehicle is bumped, the impact initially sets it in motion. The vehicle subsequently collides, for example, with an obstacle, an accident again being recognized. In this situation, a comparatively large vehicle deceleration can likewise be established because the vehicle was briefly in motion as a result of being bumped. This can be recognized by an observation being made as to whether the vehicle was in motion for a defined minimum period before the recognized accident. In the event of another vehicle colliding with a stationary vehicle, it can be concluded that this collision is intended to trigger the emergency unlocking of the stationary vehicle.

Preferably, automatic unlocking is only ever carried out if the ignition

of the internal combustion engine of the vehicle is switched on.

As a result, it can additionally be recognized whether the vehicle is in operation or is parked.

Preferably, automatic unlocking is carried out independently of the operating state of the internal combustion engine and/or the performance of the vehicle before the accident recognized by the unit and/or the wheel rotational speeds if the severity of the accident recognized by the unit exceeds a defined threshold which is greater than the threshold value precisely at which an accident is recognized.

From a defined severity of the accident it can be concluded that for the person actually causing the accident the collision of the vehicle is associated with such a great risk for his own health, i.e. he could himself become injured in the accident, that in this case too emergency unlocking can be carried out because the person causing the accident will no longer be able to put his plan of seizing the vehicle or one of the passengers into action. A further criterion is that above a defined severity of the accident, the vehicle passengers very rapidly need other help so that other considerations, such as safety of the property, take second place.

Preferably, automatic unlocking is carried out independently of the operating state of the internal combustion engine and/or the performance of the vehicle before the accident recognized by the unit and/or the wheel rotational speeds if the accident situation recognized by the unit involves the vehicle overturning.

The unit may, for example, have an overturning sensor so that a differentiation can be made between overturning and an impact against an obstacle without overturning. In the event of the vehicle being struck in order to seize the vehicle or the occupants, the vehicle is generally struck such that the vehicle does not suffer very much damage so as not to damage the vehicle too much or to injure the passengers in a life-threatening manner. This means that overturning of the struck vehicle typically constitutes a "genuine" accident.

These measures are particularly advantageous in the case of special protective vehicles whose occupants are particularly at risk from criminal use of force, for example kidnapping or attacks against a stationary vehicle. Occasionally, the bumping of vehicles takes place even in the case of normal vehicles, in order to rob the occupants.

An embodiment of the invention is represented in more detail in the drawing, in which:

Fig. 1 shows a first circuit arrangement for carrying out the method, and

Fig. 2 shows a further circuit arrangement for carrying out the method.

Figure 1 shows a first circuit arrangement for carrying out the method, in which arrangement a control unit 101 of a central locking device can be activated in such a manner that it emits an activation signal 102 resulting in the vehicle doors being opened.

The control unit 101 is fed a signal 103 which is emitted by an accident recognition unit if this unit has recognized an accident. An additional signal 104 can furthermore be fed, which signal is emitted if the recognized accident is recognized as involving the vehicle overturning. Overturning sensors of this type are known, for example from cabriolets, in which when overturning is recognized, roll bars or specially strengthened neck supports swing out or extend.

An additional signal 105 is furthermore fed to the control unit 101, which signal, in the embodiment shown in Figure 1, is emitted by an AND element 106. In this AND element various signals are connected to one another.

The AND element 106 is fed a signal which is derived from the generator 107 of the vehicle. This signal of the generator 107 is fed to the AND element 106 via a negating element 108. The signal fed to the AND element 106 consequently has the level "logic 1" if no voltage is generated by the generator, i.e. if the internal combustion engine of the vehicle is not operating.

The AND element 106 is furthermore fed a signal 109 which is representative of whether the ignition of the internal combustion engine of the vehicle is switched on.

The AND element 106 is furthermore fed a signal 110. This signal has the level "logic 1" whenever the wheel rotational speed of one or more wheels is equal to 0 within the time frame of the recognized accident. It may be meaningful here to consider the rotational speeds of a number of wheels since, for example in the event of overturning, individual wheels of the vehicle can continue to rotate. After an accident the vehicle stops thereby enabling the conclusion to be drawn that an accident necessitating triggering of the emergency unlocking has not taken place if the rotational

speed of one or more wheels is not equal to 0 within the time frame of the recognized accident.

It is also, for example, possible not to feed all of the signals to the AND element 106. For example, in addition to the signal of the accident recognition unit, it is possible only for the signal of the rotational speed of one or more wheels to be evaluated in the control unit 101. Instead of this rotational-speed signal, it is also possible only for the signal of the generator to be evaluated.

The signal 102 is only emitted by the control unit if the signal 103 is applied. Furthermore, a check is carried out as to whether a signal corresponding to a logic 1 from the AND element 106 is present. Only then is the emergency unlocking triggered because otherwise a conclusion is made that although an accident has occurred it could possibly be attributed to the fact that the vehicle has been struck in order to trigger the emergency unlocking so as to gain access to the vehicle or the occupants thereof.

Independently of other criteria, in the embodiment shown, the emergency unlocking is always triggered if it is recognized, corresponding to the signal 104, that the accident involves overturning.

Figure 2 shows a further circuit arrangement for carrying out the method, in which arrangement components identical to those in Figure 1 are provided with the same reference numbers so that a separate description thereof in conjunction with Figure 2 can be left out.

In the circuit arrangement of Figure 2 there is a timer 211 which is active if the ignition is switched on, this being realized by the signal 109, which represents the state "ignition on", being applied to a reset input of the timer 211 via a negating element 213.

The signal 109 is furthermore fed to one input of the AND element 106.

The timer 211 has an RC element 212 which has a time constant, for example, in the order of magnitude of 200 ms. If the wheel rotational speed of one or more wheels has a great deceleration, a signal 210 is correspondingly fed to the timer. By means of this signal the timer releases the AND element 106 for the duration of the time constants of the RC element.

If therefore, during this duration of the time constants the control unit

101 is fed a signal 103 that an accident has been recognized, the signal 102 for triggering the emergency unlocking is emitted.

In this arrangement, it is in turn provided that the control unit 101 is fed a signal 104 which is emitted whenever the accident is recognized as involving overturning. In this case, the emergency unlocking is triggered independently of the signal 105.

It is also possible for the signal 210 only to be emitted if the travelling speed of the vehicle before the pronounced deceleration was not equal to 0 for a certain period of time, i.e. the vehicle was in motion. As a result, it is possible for, for example, bumping of a stationary vehicle, in which the vehicle is pushed onto an obstacle, to be recognized.

In both circuit arrangements it is possible to provide a further signal which represents the severity of the recognized accident. Above a defined severity of the accident, emergency unlocking of the vehicle is always triggered independently of the signal 105. In this arrangement, it is possible, for example, to establish a first threshold value of the deceleration, from which value an accident is recognized. The emergency unlocking is triggered whenever the signal 105 is present at the same time or if the accident is recognized as involving overturning. It is furthermore possible to establish a second threshold value of the deceleration, which value is of larger magnitude than the first threshold value. If a deceleration ensues which is of larger magnitude than this second threshold value, the emergency unlocking is then likewise always triggered.

Bumping of a vehicle in order to trigger the emergency unlocking generally takes place in such a manner that the bumped vehicle is not too severely damaged in order, in the event of theft of the vehicle, not to damage the latter too severely and in order ultimately not to injure the occupants in a life-threatening manner. The second threshold value is therefore selected such that the emergency unlocking is always triggered above a defined severity of the recognized accident.



Claims

1. A method for the emergency unlocking of a vehicle involved in an accident, the occurrence of an accident being recognized by an accident recognition unit on account of the evaluation of sensor signals, automatic unlocking of the vehicle being carried out after an accident recognized by the unit, wherein automatic unlocking is only ever carried out if the rotational-speed signal of one or more wheels of the vehicle assumes the value zero within a certain accident time frame.
2. A method for the emergency unlocking of a vehicle involved in an accident, the occurrence of an accident being recognized by an accident recognition unit on account of the evaluation of sensor signals, automatic unlocking of the vehicle being carried out after an accident recognized by the unit, wherein automatic unlocking is only ever carried out if the output voltage of the generator of the vehicle assumes the value zero within a certain accident time frame.
3. A method according to Claim 1, wherein automatic unlocking is only ever carried out if the output voltage of the generator of the vehicle assumes the value zero within a certain accident time frame.
4. A method for the emergency unlocking of a vehicle involved in an accident, the occurrence of an accident being recognized by an accident recognition unit on account of the evaluation of sensor signals, automatic unlocking of the vehicle being carried out after an accident recognized by the unit, wherein automatic unlocking is only ever carried out if an accident has been recognized by the accident recognition unit within a specified period of time after the vehicle speed is reduced from a value which is not equal to zero to the value zero with a deceleration which is greater than a defined threshold value.
5. A method according to Claim 4, wherein automatic unlocking is only ever carried out if the vehicle speed was greater than a defined minimum amount for

a certain time before being reduced to zero with the deceleration which is greater than the defined threshold value.

6. A method according to any one of Claims 1 to 5, wherein automatic unlocking is only ever carried out if the ignition of the internal combustion engine of the vehicle is switched on.
7. A method according to any one of Claims 1 to 6, wherein automatic unlocking is carried out independently of the operating state of the internal combustion engine and/or the performance of the vehicle before the accident recognized by the unit and/or the wheel rotational speeds if the severity of the accident recognized by the unit exceeds a defined threshold which is greater than the threshold value precisely at which an accident is recognized.
8. A method according to any one of Claims 1 to 7, wherein automatic unlocking is carried out independently of the operating state of the internal combustion engine and/or the performance of the vehicle before the accident recognized by the unit and/or the wheel rotational speeds if the accident situation recognized by the unit involves the vehicle overturning.
9. A method for the emergency unlocking of a vehicle involved in an accident, substantially as described herein with reference to and as illustrated in the accompanying drawings.



Application No: GB 9825201.8  
Claims searched: All

Examiner: Mr A Angele  
Date of search: 29 January 1999

**Patents Act 1977**  
**Search Report under Section 17**

**Databases searched:**

UK Patent Office collections, including GB, EP, WO & US patent specifications, in:

UK Cl (Ed.Q): E2A {(ABX or ABJ) and (A401 or A431)}  
G4N {NHVSC and (N5C1 or N5C2)}

Int Cl (Ed.6): E05B-065/20 or B60R-025/10

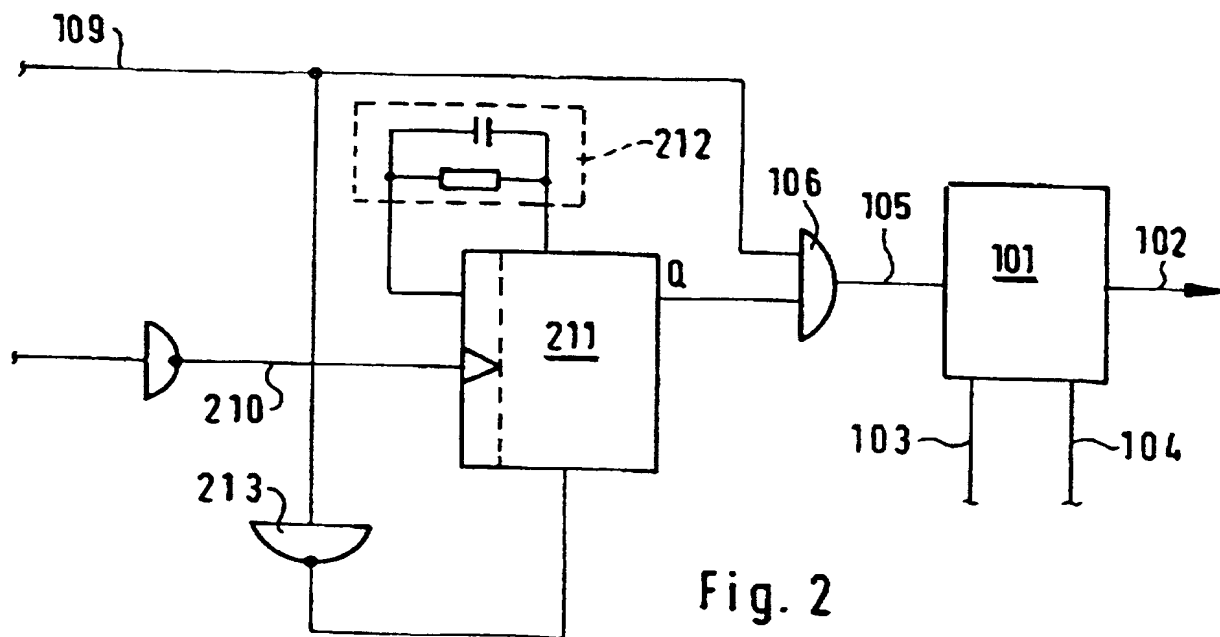
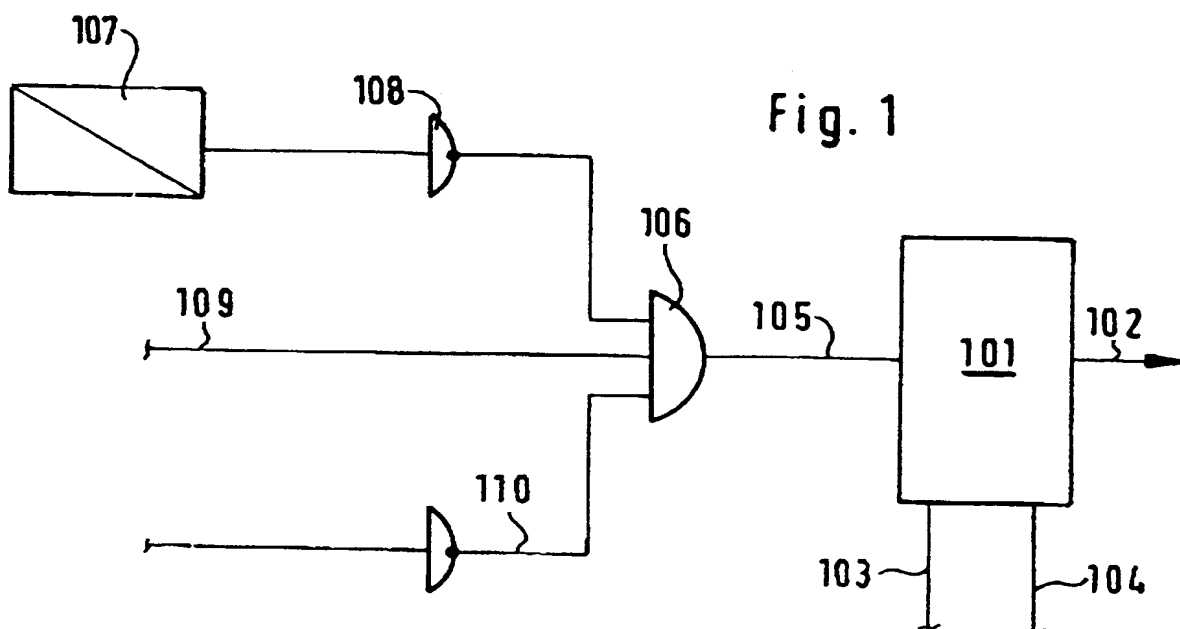
Other: ONLINE: EDOC

**Documents considered to be relevant:**

Category	Identity of document and relevant passage	Relevant to claims
A	GB 2292126 A ROVER GROUP Ltd.	
A	US 5243322 A THOMPSON et al.	
A	US 4995654 A MAZDA MOTOR Corp.	
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